US010668871B2

(12) **United States Patent**
Yon

(10) **Patent No.: US 10,668,871 B2**
(45) **Date of Patent: Jun. 2, 2020**

(54) **RETAINING DEVICE, IN PARTICULAR FOR REMOVABLY CONNECTING VEHICLE BODY PARTS**

(71) Applicant: **ILLINOIS TOOL WORKS INC.**, Glenview, IL (US)

(72) Inventor: **Fulvio Pacifico Yon**, Donnas (IT)

(73) Assignee: **ILLINOIS TOOL WORKS INC.**, Glenview, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 443 days.

(21) Appl. No.: **15/508,579**

(22) PCT Filed: **Sep. 15, 2015**

(86) PCT No.: **PCT/US2015/050156**
§ 371 (c)(1),
(2) Date: **Mar. 3, 2017**

(87) PCT Pub. No.: **WO2016/069125**
PCT Pub. Date: **May 6, 2016**

(65) **Prior Publication Data**

US 2017/0240121 A1 Aug. 24, 2017

(30) **Foreign Application Priority Data**

Oct. 31, 2014 (IT) TO2014A0901

(51) **Int. Cl.**
B60R 13/02 (2006.01)
F16B 5/06 (2006.01)
F16B 21/08 (2006.01)

(52) **U.S. Cl.**
CPC ***B60R 13/0206*** (2013.01); ***F16B 5/0642*** (2013.01); ***F16B 21/086*** (2013.01); *Y10T 403/75* (2015.01)

(58) **Field of Classification Search**
CPC .. B60R 13/0206; F16B 5/0084; F16B 5/0088; F16B 5/0092; F16B 5/0642;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,658,110 A * 8/1997 Kraus F16B 21/086 411/510
6,305,055 B1 10/2001 Castro
(Continued)

FOREIGN PATENT DOCUMENTS

EP	0543388		5/1993	
FR	911056	A *	6/1946	..... F16B 21/086
GB	1319961		6/1973	

OTHER PUBLICATIONS

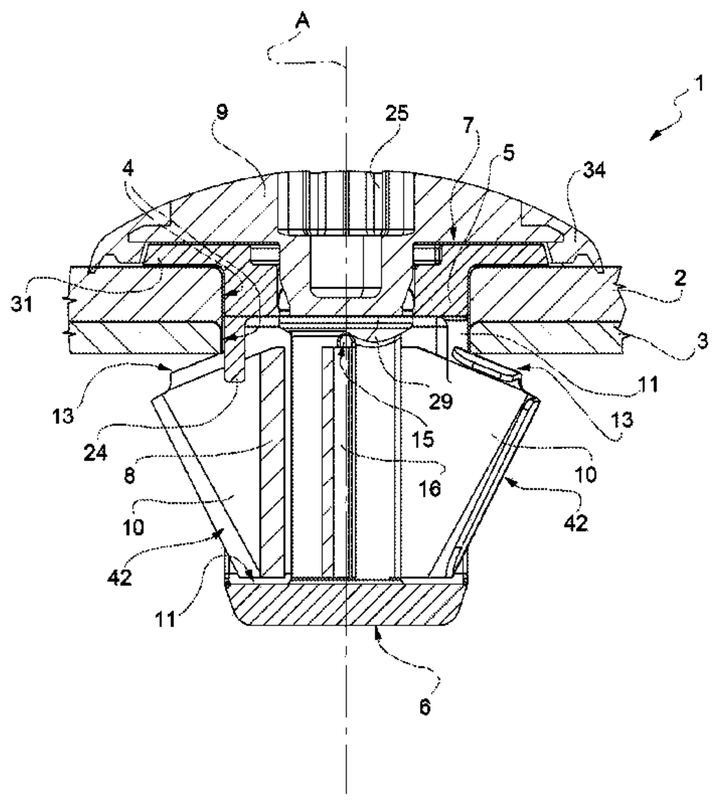
PCT, International Search Report and Written Opinion, International Application No. PCT/US2015/050156, dated Dec. 16, 2015, 12 pages.

Primary Examiner — Josh Skroupa
(74) *Attorney, Agent, or Firm* — Thompson Hine LLP

(57) **ABSTRACT**

A retaining device (**1**) including: a box-like element (**5**) designed so that it can be inserted so as to pass through a perforation (**4**) of parts to be connected; a pivot (**8**) mounted inside the box-like element rotatably about an axis (A) of symmetry thereof and provided with a head (**9**) arranged on the outside of the box-like element; and a pair of elastically deformable wings (**10**) mounted in an angularly integral manner on the pivot (**8**) and projecting from opposite sides transversely so as to jut out through a pair of opposite through-windows (**11**) formed in a side wall (**12**) of the box-like element (**5**) and designed to assume an elastically deformed or retracted configuration, in which they are fully folded up inside the box-like element (**5**).

13 Claims, 7 Drawing Sheets



(58) **Field of Classification Search**
CPC F16B 21/02; F16B 21/086; Y10T 403/59; Y10T 403/591; Y10T 403/608; Y10T 403/75
USPC 403/321, 322.1, 330, 408.1
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,807,900	B2 *	8/2014	Ramsauer	E05B 9/084 411/347
2005/0019132	A1	1/2005	Diaz	
2012/0227226	A1 *	9/2012	Sasaki	F16B 21/086 24/703.1

* cited by examiner

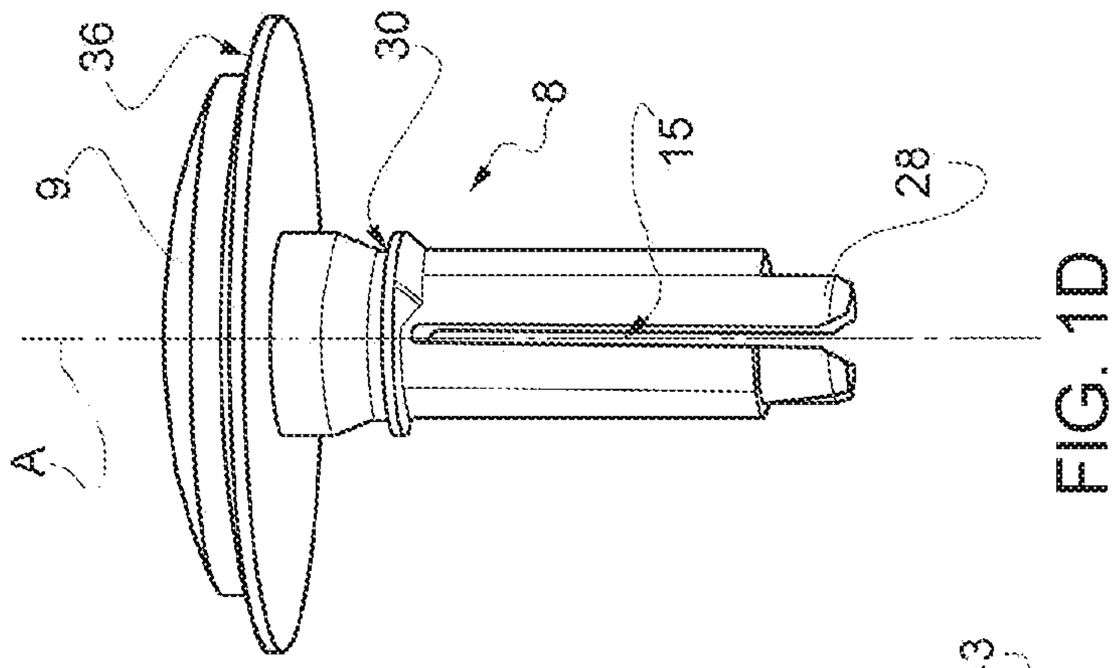


FIG. 1D

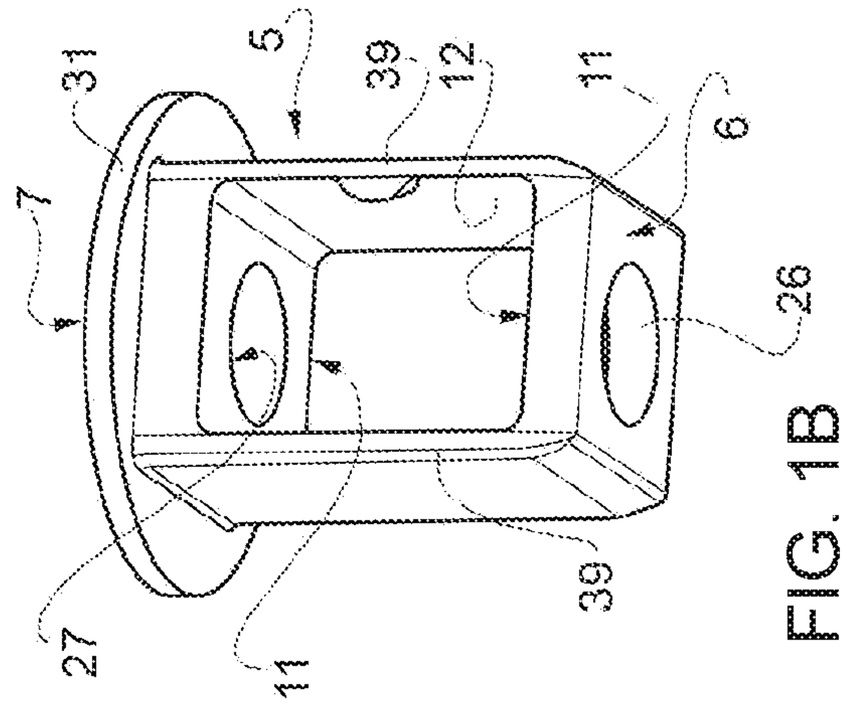


FIG. 1B

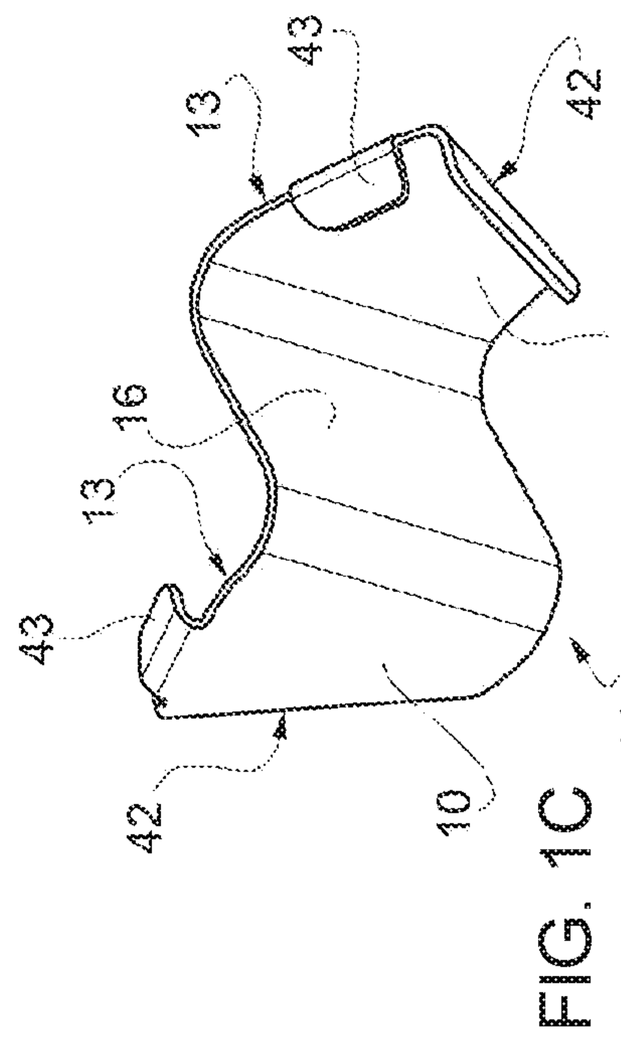


FIG. 1C

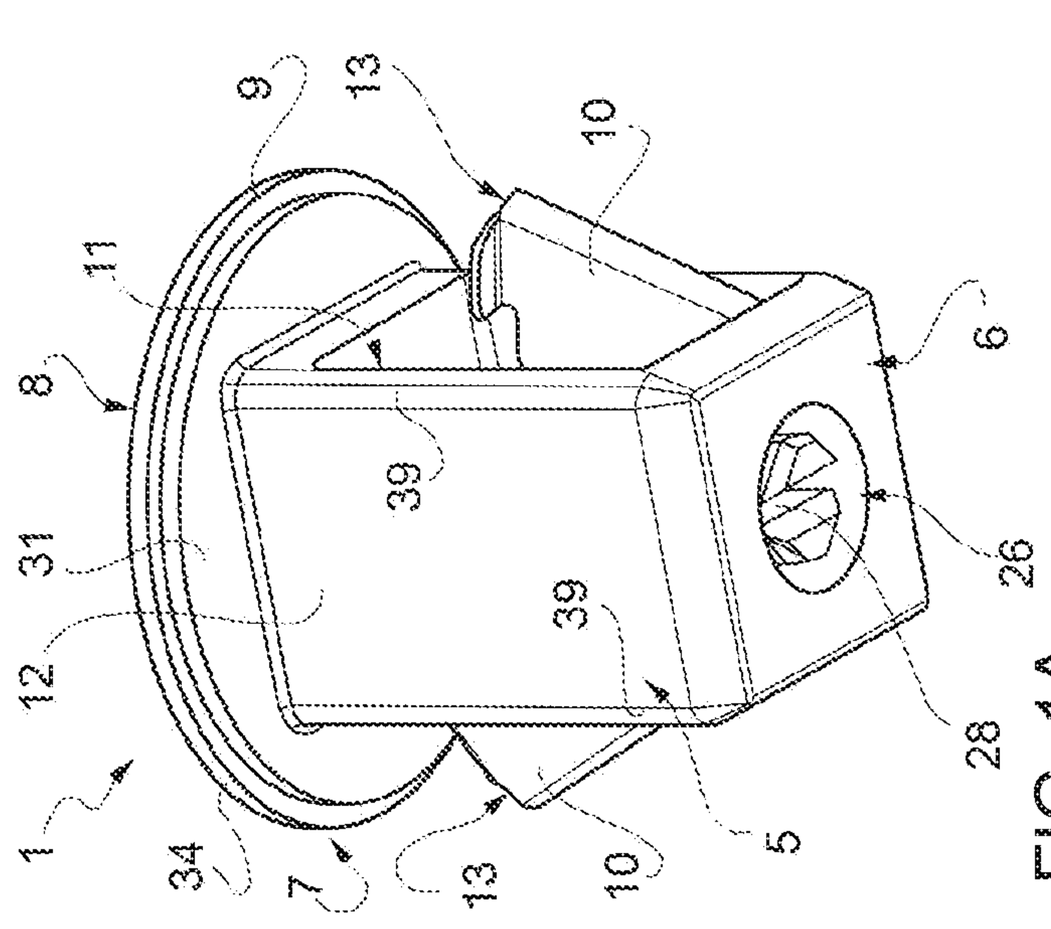


FIG. 1A

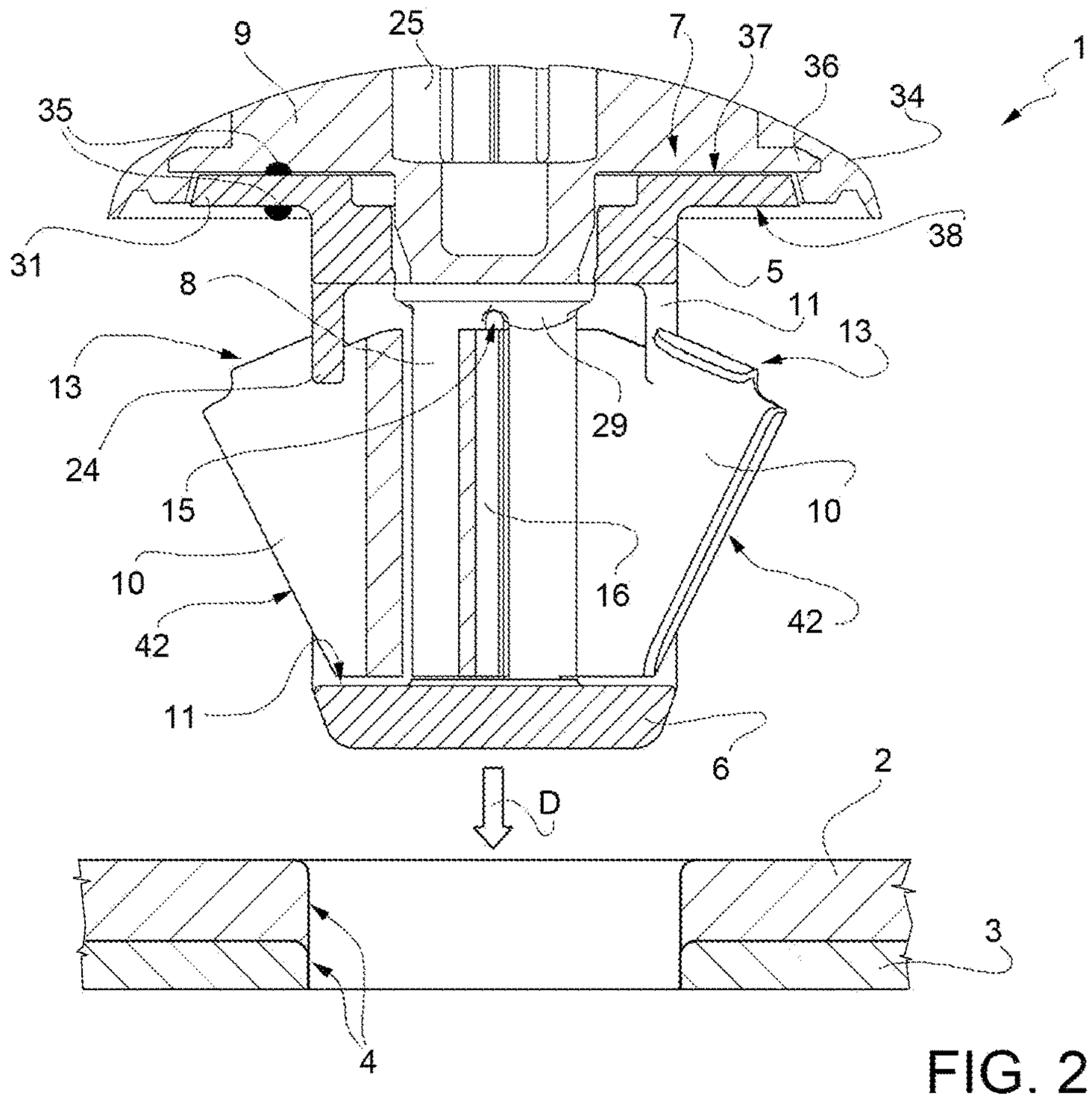

9
25
7
37
36
34
1
35
31
38
5
8
11
13
13
29
24
15
10
10
16
42
42
11
6
D
2
3
4

FIG. 2

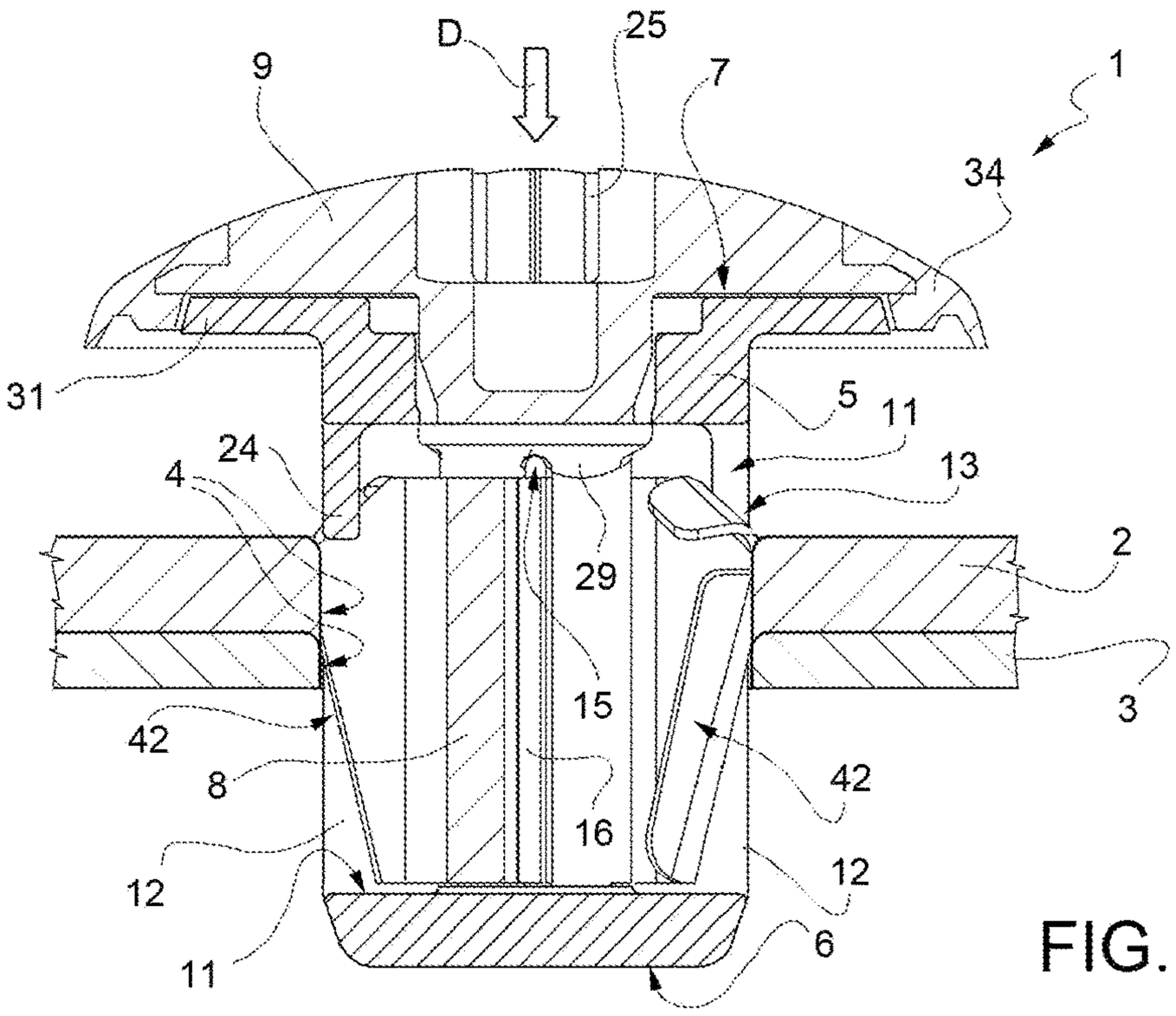

D
25
9
7
1
34
31
5
11
24
4
13
29
2
15
3
42
8
42
16
12
12
11
6

FIG. 3

FIG. 4

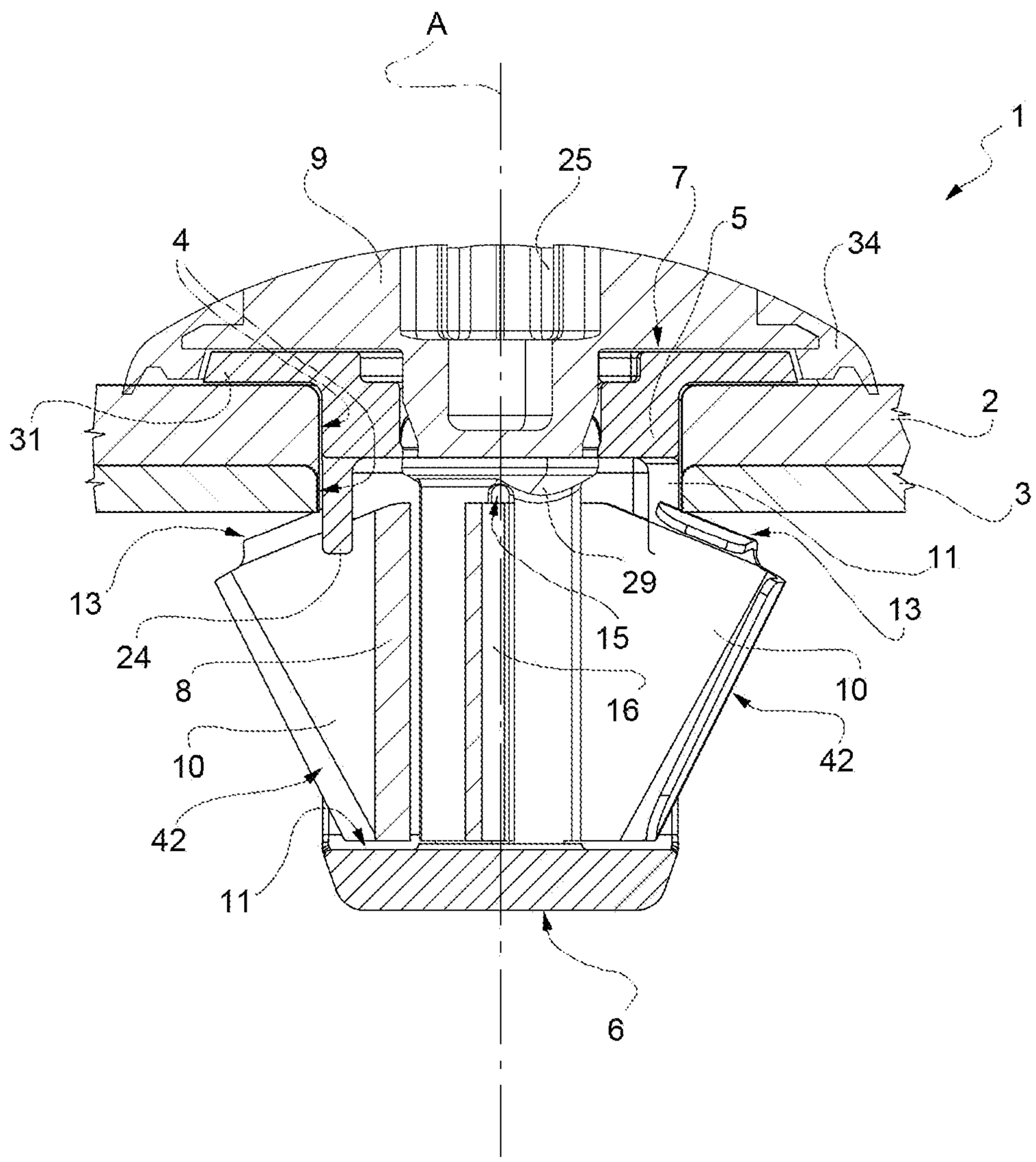


FIG. 6

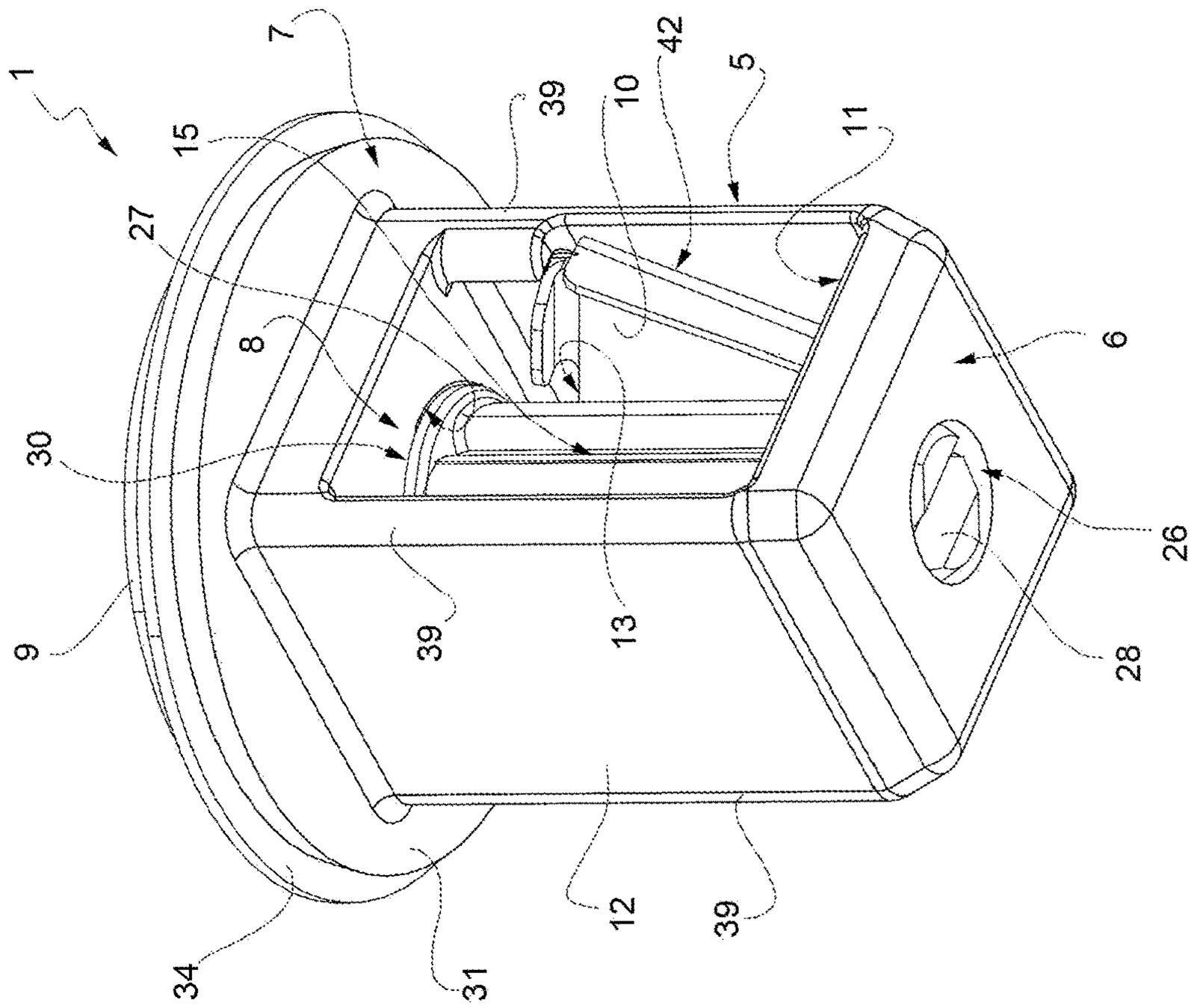
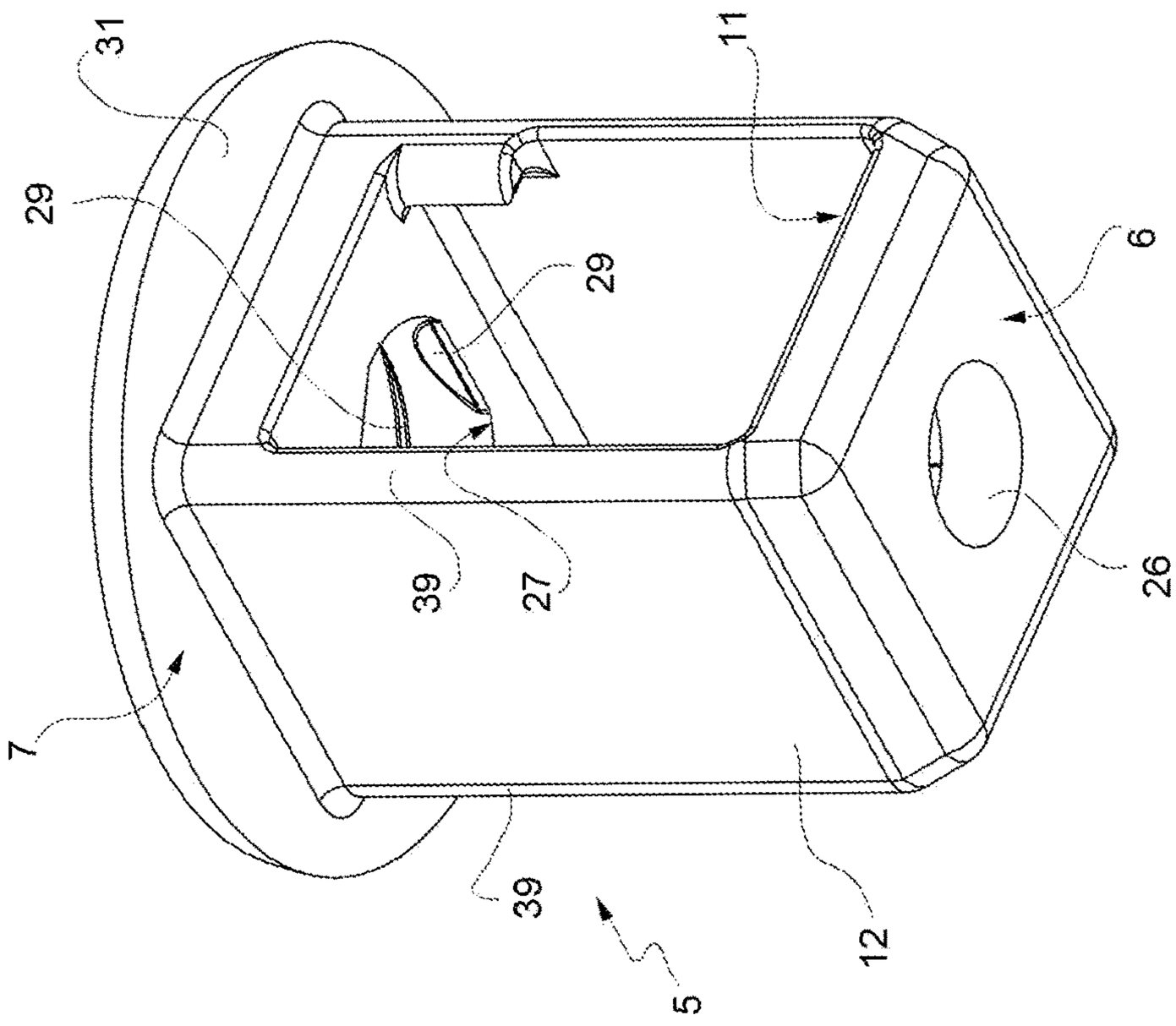

1
7
15
39
10
42
5
11
27
8
6
30
26
9
39
13
28
12
39
34
31

FIG. 5


31
11
29
29
6
39
27
26
7
39
12
5

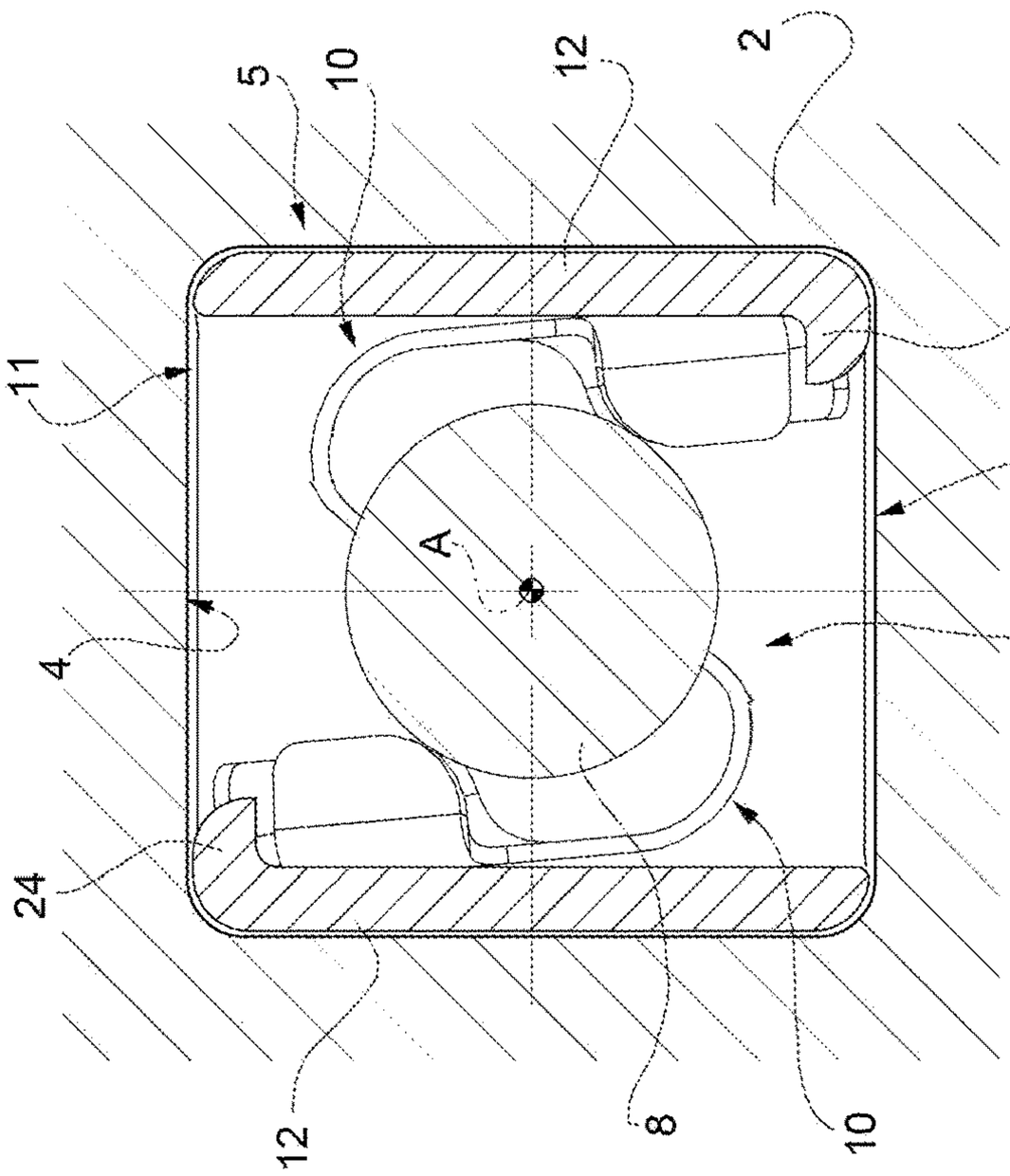


FIG. 8

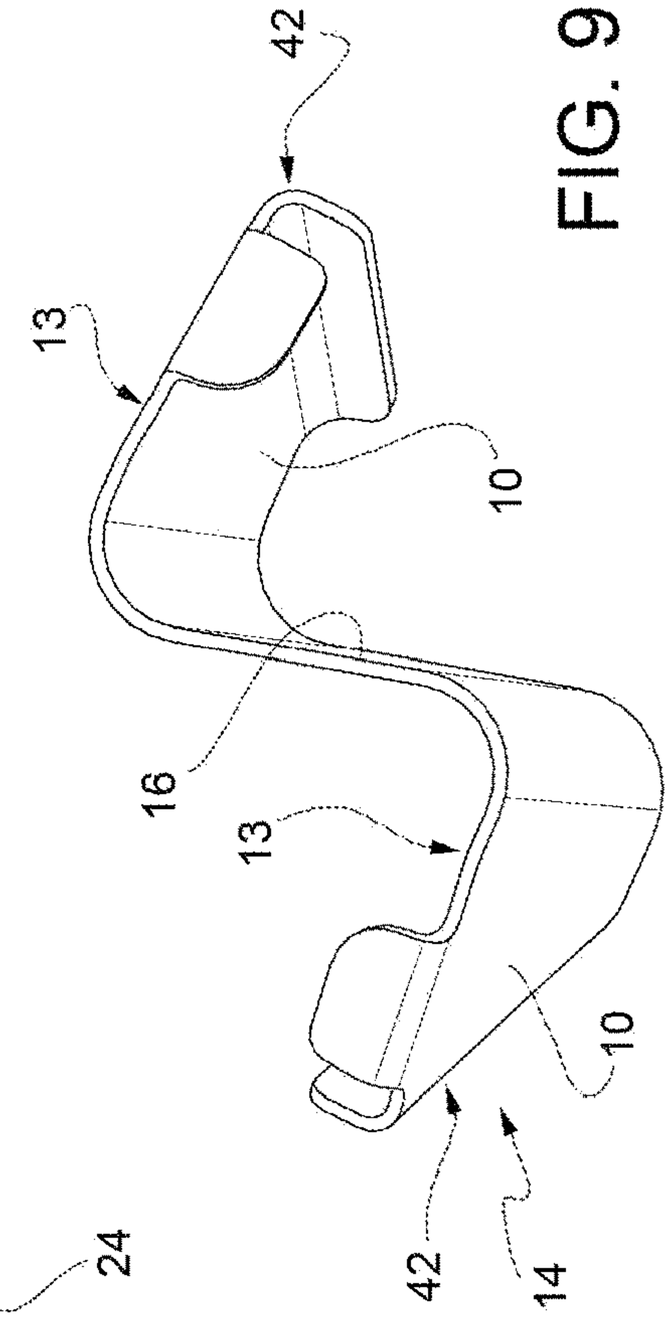


FIG. 9

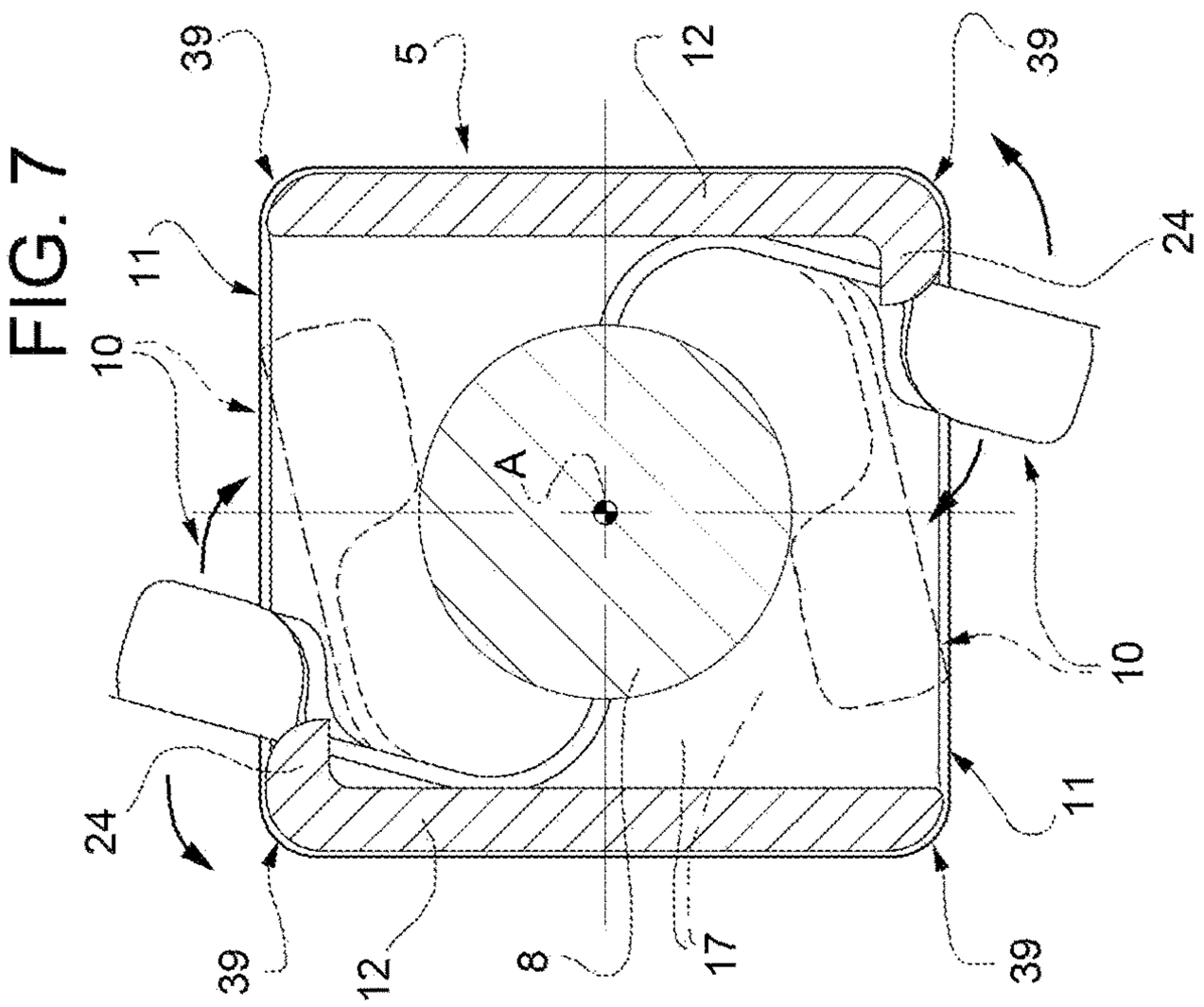


FIG. 7

FIG. 10

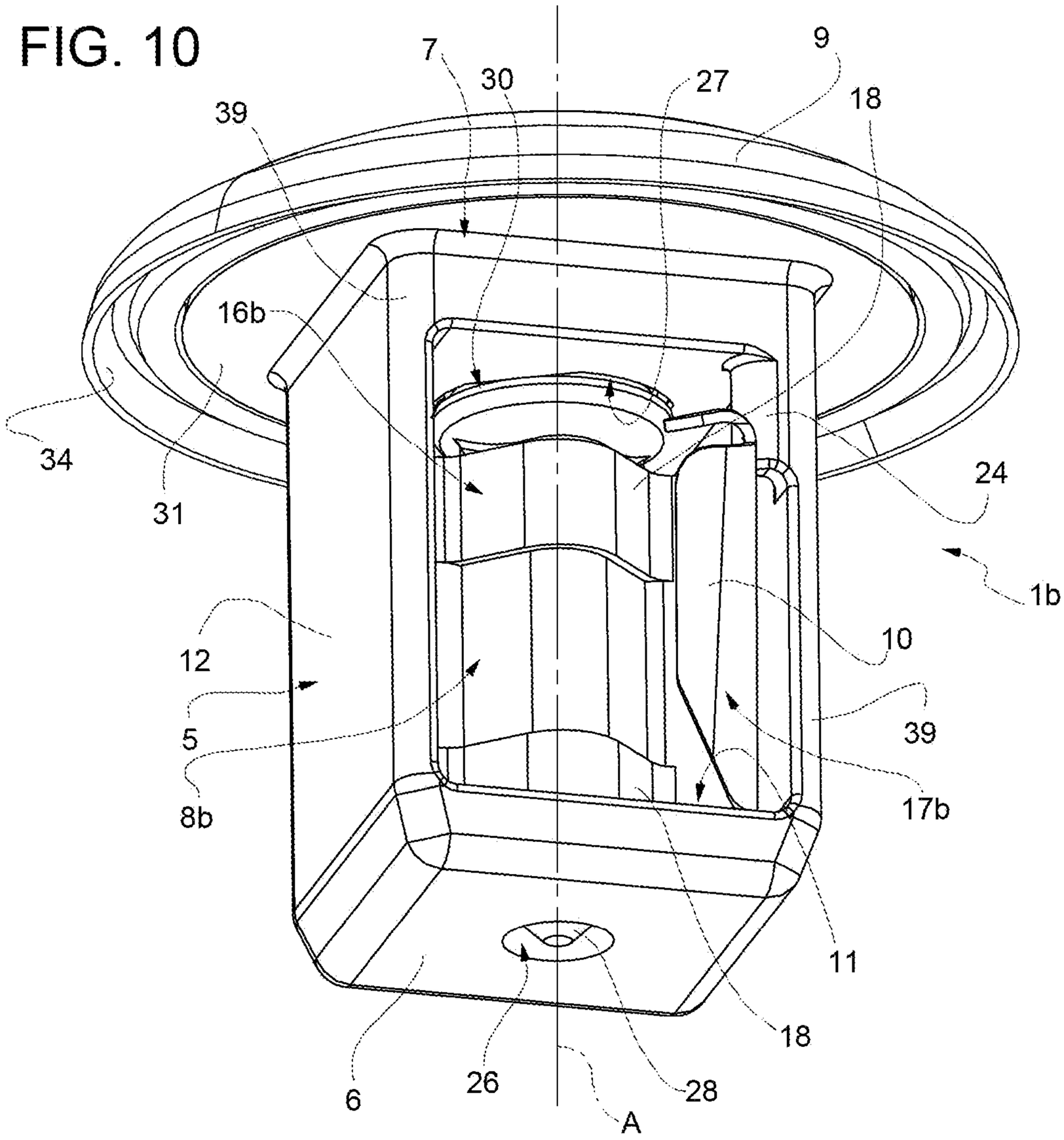

7
30
27
9
18
39
16b
34
31
24
1b
12
10
5
39
8b
17b
11
18
6
26
28
A

FIG. 11

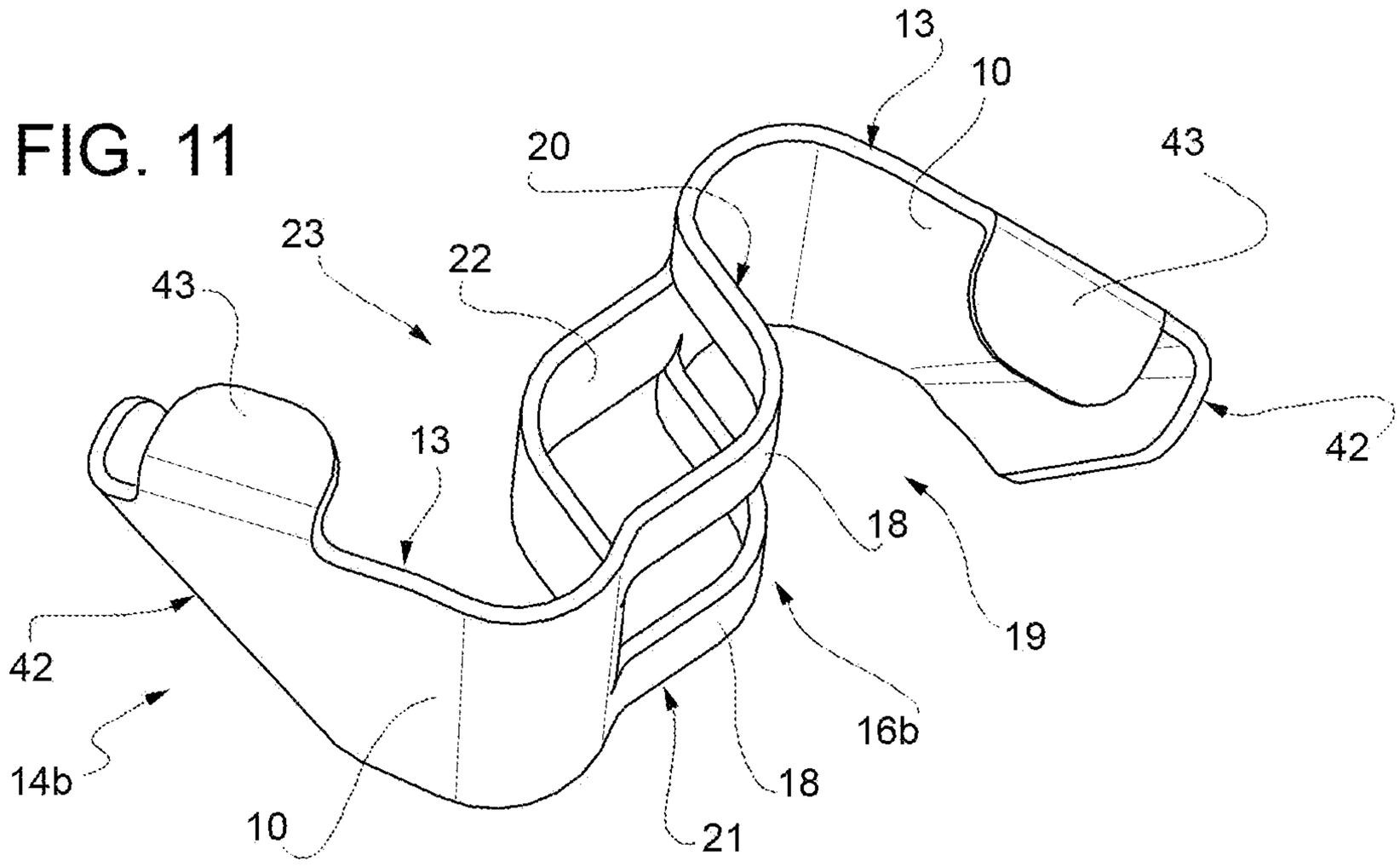

13
10
20
43
23
22
43
13
42
18
19
42
16b
14b
18
10
21

FIG. 13

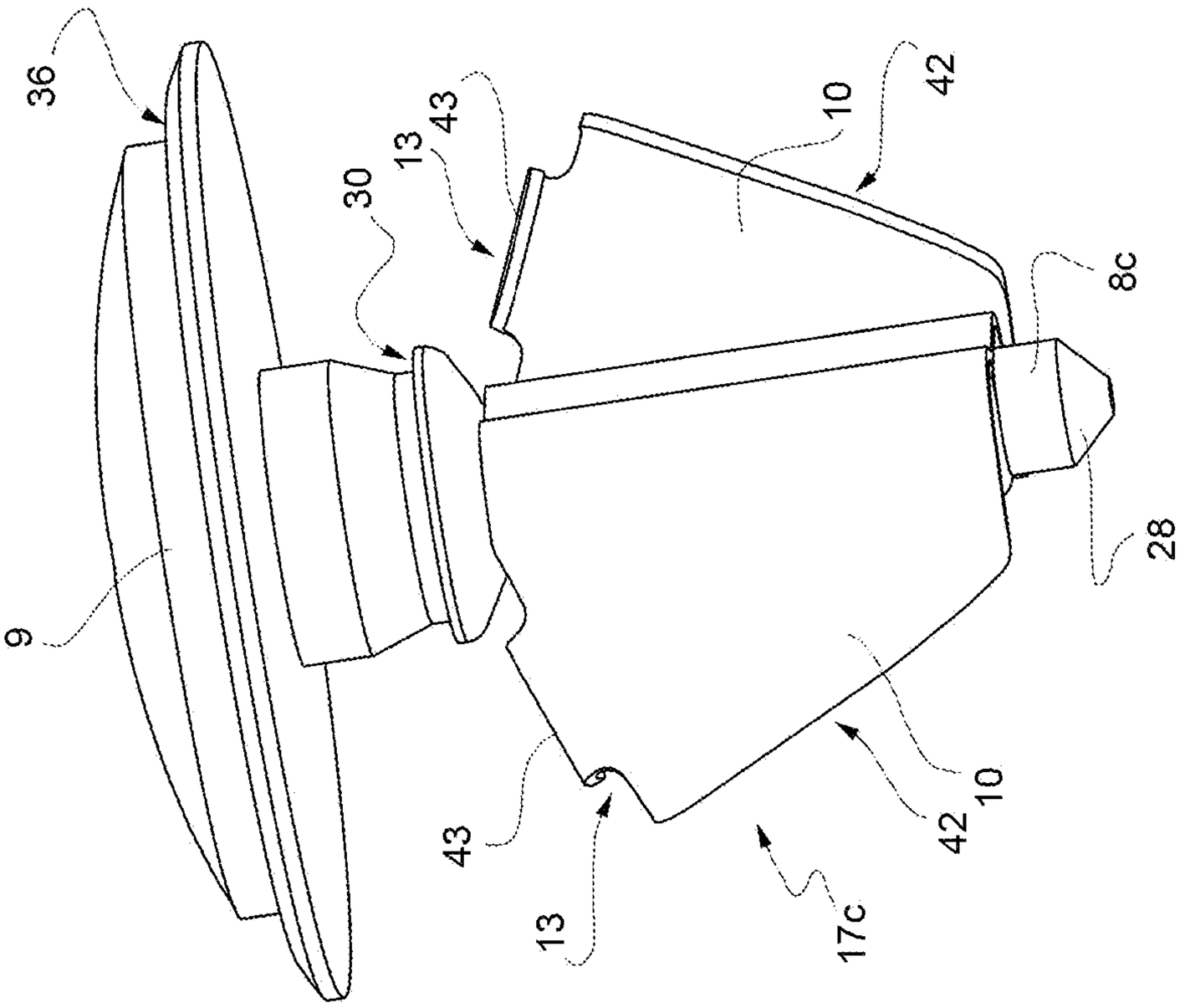
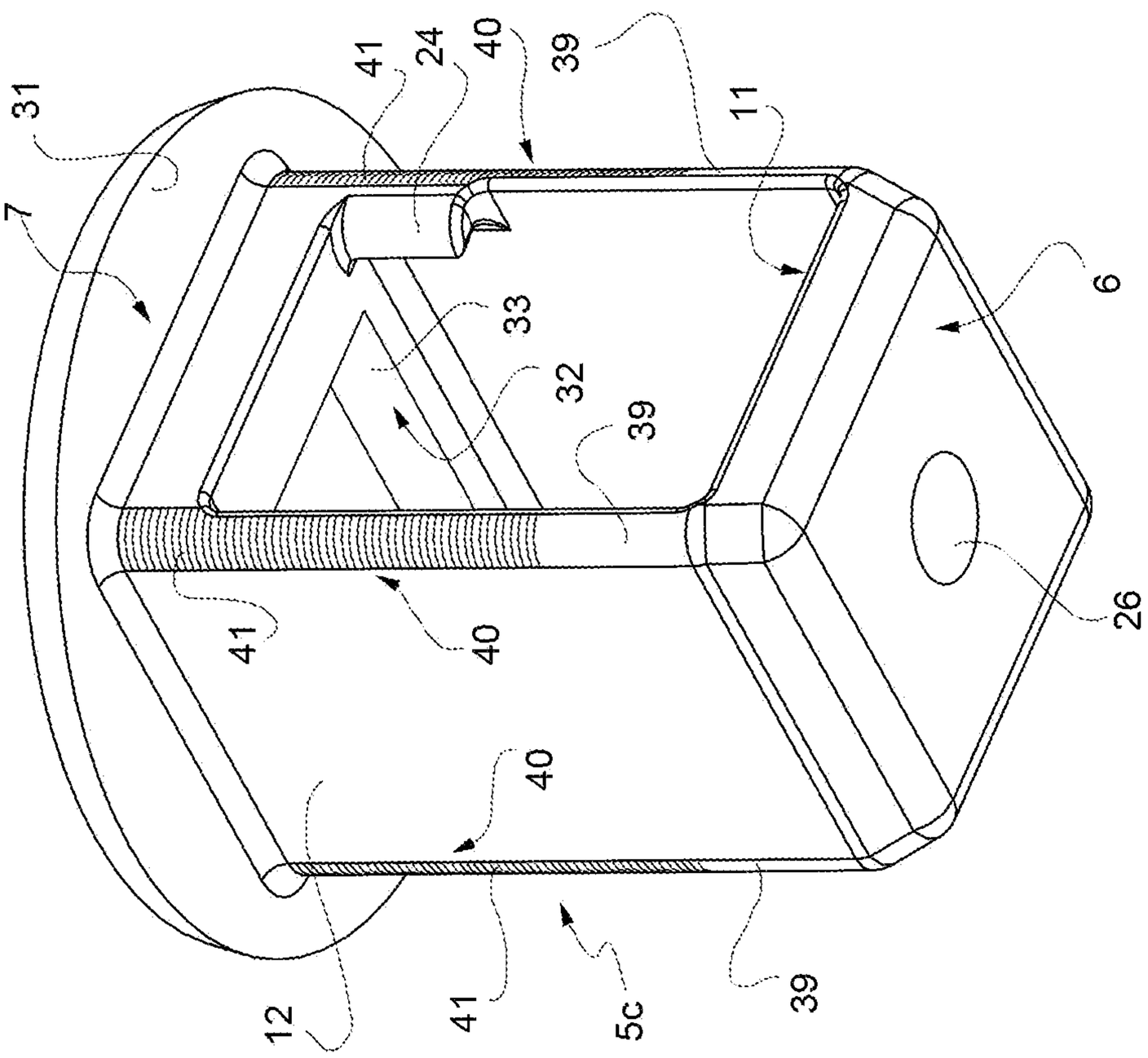

36
43
13
30
10
42
8c
28
9
43
13
42
10
17c

FIG. 12


41
24
40
39
31
11
7
6
33
32
39
26
41
40
12
41
5c
39

RETAINING DEVICE, IN PARTICULAR FOR REMOVABLY CONNECTING VEHICLE BODY PARTS

TECHNICAL FIELD

The present invention relates to a retaining device, in particular for connecting together vehicle body parts, in particular for connecting a finishing element to a vehicle body in a removable manner, namely with the possibility of performing repeated assembly and disassembly without the risk of damage.

BACKGROUND

It is known that, in the motor-vehicle sector, in order to achieve the fixing together of body parts, for example the fixing of an internal finishing panel to the frame of a door or side of the passenger compartment of a vehicle, retaining devices of various types, e.g. snap-engaging or bayonet type, are used.

However, these retaining devices are not suitable for allowing disassembly of the parts connected by them without the risk of causing possible damage and/or without causing the breakage of the retaining device, in particular those devices of the type able to be assembled by means of snap-engagement.

The only known retaining device which can be reused and is suitable for allowing also frequent assembly and disassembly without the risk of damage is the screw. However, connecting together body parts by means of screws would be costly and would slow down the operations of assembly of the parts to be joined together owing to the time needed to perform screwing of the screws.

SUMMARY

It is an object of the present invention to overcome the drawbacks of the present state of the art by providing a retaining device which has a simple, reliable, compact and relatively low-cost design, allowing the fixing together of two parts, in particular two vehicle body parts, rapidly and in a manner allowing easy disassembly without the risk of damaging the parts fixed by them, and which can be used again after disassembly, thus being advantageously able to replace screws.

The present invention therefore relates to a retaining device as defined in the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristic features and advantages of the invention will become clear from the following description of three possible embodiments of the invention, provided purely by way of a non-limiting example, with reference to the accompanying drawings in which:

FIG. **1**A shows a perspective view of a retaining device according to a first embodiment of the invention, shown assembled, and FIGS. **1**B-**1**D show an exploded perspective view of its components;

FIGS. **2**, **3** and **4** show respective longitudinal orthogonal views, in staggered cross-section, of the retaining device according to FIG. **1**A in three different working positions with respect to a pair of parts to be connected;

FIG. **5** shows a perspective three-quarters view from below of a component of the retaining device according to FIG. **1**A;

FIG. **6** shows the same perspective view as in FIG. **5** of the retaining device according to FIG. **1**A in the assembled condition;

FIGS. **7** and **8** show respective schematic cross-sectional plan views of the retaining device according to the invention, illustrating operation thereof;

FIG. **9** shows a perspective three-quarters view, on a smaller scale, from above, of another component of the retaining device according to FIG. **1**A;

FIGS. **10** and **11** show respective perspective views of a second embodiment of the retaining device according to the invention and a component thereof; and

FIGS. **12** and **13** show respective perspective views of a third embodiment of the retaining device according to the invention and a component thereof.

DETAILED DESCRIPTION

With reference to FIGS. **1**A-**1**D and FIGS. **2** to **8**, **1** denotes overall a retaining device, in particular for connecting together two vehicle body parts **2**,**3** provided with corresponding through-perforations **4**. The body parts **2**,**3** may be of any kind and in the example shown consist of a synthetic finishing panel **2** and a sheet-metal body frame **3**. The perforations **4** may be round, but may also have another shape.

The retaining device **1** comprises a box-like element or "cage" **5** which is designed so that it can be inserted so as to pass through the perforation **4** of the parts to be connected **2**,**3** and has a first end **6** directed in a direction D (FIGS. **2** and **3**) for inserting during use the retaining device **1** inside the through-perforation **4** of the parts **2**,**3** to be connected, and a second end **7**, opposite to the first end.

The retaining device **1** further comprises a pivot **8** mounted inside the box-like element **5** rotatably about an axis of symmetry A thereof and provided with a head **9** arranged on the outside of the box-like element **5**, at the second end **7** of the box-like element **5**.

The retaining device **1** comprises finally a pair of elastically deformable wings **10** (FIG. **1**A) which, in FIGS. **1**A and **2**, are shown in a configuration where they project laterally jutting out from the box-like body **5**.

In particular, the elastically deformable wings **10** are mounted in an angularly integral manner on the pivot **8** and, principally, extend longitudinally, i.e. they extend in a direction parallel to the axis A of the pivot **8** from which they project on opposite sides transversely jutting out, extending also, secondarily, transversely relative to the axis A.

According to an aspect of the invention, the wings **10** are formed so as to be suitable for assuming selectively two different configurations and, precisely, an undeformed or extended configuration, shown in FIGS. **1**A, **2**, **4** and **7**, and an elastically deformed or retracted configuration, shown in FIGS. **3** and **8** in continuous lines and in FIG. **7** in broken lines.

In the undeformed or extended configuration, the wings **10** have an L-shaped form in a plane perpendicular to the axis of symmetry A of the pivot **8** (plane of the sheet in FIGS. **7**,**8**) and project radially jutting out from the box-like element **5**, through a pair of opposite through-windows **11** formed through a side wall **12** of the box-like element **5**.

In the elastically deformed or retracted condition, on the other hand, the wings **10** are entirely folded up inside the box-like element **5**, assuming a U-shaped form in a plane perpendicular to the axis of symmetry A of the pivot **8** (plane of the sheet in FIGS. **7**,**8**).

The pivot **8** is selectively rotatable between a first and a second angular position; in the first angular position, shown in FIGS. **1**A and **2** to **4** and **7**, the wings **10** are situated facing the pair of opposite through-windows **11** of the box-like element **5**; in the second angular position, shown in FIGS. **6** and **8**, the wings **10** cooperate making contact with the side wall **12** of the box-like element **5** so as to be forced to assume the deformed or retracted configuration.

In combination with that described hitherto, the wings **10** are configured/designed to snap-engage, when the pivot **8** is in the first angular position (FIG. **3**), inside the through-perforations **4** of the parts **2**,**3** to be connected, so as to clamp the latter together (FIG. **4**) between the head **9** of the pivot **8** and respective transversal rims **13** of the wings **10** directed towards the second end **7** of the box-like element **5**.

For this purpose, the pivot **8** and the wings **10** are designed so that, between the head **9** and the rims **13**, there is always a predefined axial play which is generally substantially equal to the combined thickness of the two parts **2**,**3** to be joined together. Basically, respective points closer to the end **7** of the rims **13** are located at a distance from the head **9**, measured along the axis A, which is substantially of the same order of magnitude as the sum of the thicknesses, measured again along the axis A, of the parts **2**,**3** to be joined together. If necessary, the predefined axial play may be slightly smaller than the combined thickness of the two parts **2**,**3** to be joined together, if the two parts must be lightly pressed together. Any small variations in thickness or dimensional variations are in any case compensated for, as will be seen, by the elasticity of the wings **10**.

According to a non-limiting example shown in FIGS. **1**A-**1**D and **2** to **9**, the wings **10** form part of a single metallic element **14** which is elastically deformable and mounted in an angularly integral manner on the pivot **8** and is made of sheet metal cut and bent so as to assume an overall S-shaped form.

In particular, the pivot **8** has a transverse slot **15** passing from side to side (i.e. transversely with respect to the axis A) and extending longitudinally, parallel to the axis A of the pivot **8**, and the metallic elastic element **14** has a flat central portion **16** which connects together the wings **10** and which engages passing through the transverse slot **15** of the pivot **8** so as to form together with the latter a single rotating unit, indicated schematically by **17** in FIGS. **7** and **8**.

With reference to FIGS. **10** and **11**, where details similar to or the same as those already described are indicated for the sake of simplicity by means of the same reference numbers, these show a variant **1***b* of the device **1**, which is identical to that already described except for the constructional design of the rotating unit **17**, which is replaced by a rotating unit **17***b* composed of a pivot **8***b*, which has a prismatic shape and which again comprises a head **9**, and by a metallic elastic element—again made by shearing a metal sheet—which comprises the two opposite wings **10** and a central portion **16***b* which connects together the wings **10** and which is configured as a radially deformable elastic prismatic sleeve which is fitted by means of interference onto the prismatic pivot **8***b*.

In particular, the central portion **16***b* of the metallic elastic element **14***b* comprises: a pair of first straps **18** folded in an L shape radially externally on a same first side **19** of the metallic elastic element **14***b* and defining first and second opposite axial ends **20**,**21** of the central portion **16***b* of the metallic elastic element **14***b* (FIG. **11**); and a second strap **22** folded in an L shape radially externally on a second side **23** of the metallic elastic element **14***b* opposite to the first side **19**, which second strap **22** is arranged axially between the first straps **18**, on the opposite side thereto.

In both the embodiments described, the box-like element **5** of the devices **1** and **1***b* is provided, laterally at each through-window **11** and at the second end **7**, with a lateral tooth **24** designed to cooperate by means of snap-engagement, during rotation of the pivot **8**,**8***b* towards the second angular position, with a corresponding wing **10** as the latter moves towards the deformed or retracted configuration for locking by means of snap-engagement the pivot **8**,**8***b* in the second angular position.

The lateral teeth **24** are also designed to allow disengagement of the wings **10** when the pivot **8**,**8***b* is rotated in the opposite direction towards the first angular position.

In the examples shown and with particular reference to FIGS. **7** and **8**, the wings **10** are designed to assume the deformed or retracted configuration both in the first and in the second angular position of the pivot **8**,**8***b*. In the first angular position, shown in FIG. **7**, they assume the deformed configuration (shown in broken lines in FIG. **7**) as a result, as will be seen, of cooperation of the wings **10** with the perimetral edge of the perforations **4** which, during introduction of the box-element **5** into the perforations **4** in the direction D, forces the wings **10** to fold up elastically (FIG. **3**) and then click out again into the extended configuration (FIG. **4**) as soon as introduction of the box-like element **5** into said perforations **4** has been completed.

In order to remove the device **1**,**1***b* from the parts **2**,**3** and then extract it from the perforations **4** it is sufficient to rotate the pivot **8**,**8***b* towards the second angular position, in the example shown by means of an anti-clockwise rotation, so that the wings **10** are forced to cooperate against the teeth **24** which are arranged in a diametrically opposite position with respect to the axis A and jutting out into the windows **11**, one for each window **11**, in the direction of rotation of the pivot **8**,**8***b* towards the second angular position, in the example shown in the anti-clockwise direction, indicated by the arrows in FIG. **7**.

In this way the wings **10** intercept the teeth **24** and, as a result of rotation of the pivot **8**,**8***b*, are flexed towards the retracted position until they click over the teeth **24** when the pivot **8**,**8***b* reaches the second angular position, which is rotated through 90° with respect to the first position. The wings **10** are therefore locked by means of snap-engagement inside the box-like element **5** (FIG. **8**) in the bent or retracted configuration, resting against the side wall **12**, thus also locking by means of snap-engagement the pivot **8**,**8***b* in this second angular position. Since in this position the wings **10** no longer interfere with the edges of the perforations **4**, the entire device **1**,**1***b* may be extracted from them, releasing the two parts **2**,**3** to be joined together.

In order to fix again the parts **2**,**3** it is merely required to introduce again the device **1**,**1***b* into the perforations **4** when the pivot **8**,**8***b* is still angularly locked in the second angular position by the teeth **24**. Then, a rotation is applied to the pivot **8**,**8***b* in the opposite direction, in the example shown in the clockwise direction, so as to push the wings **10** against the teeth **24** which are shaped so as to cooperate with the wings **10** and force them to flex again towards the pivot **8**,**8***b* by just the amount needed for them to click over again the teeth **24**. The wings **10** are at this point free, with continued rotation of the pivot **8**,**8***b*, to unfold as a result of the elastic effect towards the extended configuration, through the windows **11**, cooperating again with the edges of the perforations **4** and clamping together again the parts **2**,**3** between their transversal rims **13** and the head **9**.

In order to allow rotation of the pivot **8**,**8***b* while applying at the same time a torque sufficient to allow the teeth **24** to be passed over, overcoming the resistance offered by the bending force induced on the wings **10**, the head **9** is provided with means for receiving a tool, in the examples shown an Allen wrench seat **25** (FIGS. **2**,**3**,**4**).

In order to allow the pivot **8**,**8***b* to be introduced and supported, the box-like element **5** is also provided at the first end **6** and the second end **7** with, respectively, a first through-hole **26** and a second through-hole **27** coaxial with the axis A of the pivot **8**,**8***b*.

The second hole **27** is designed to allow the introduction of the pivot **8**,**8***b* and the wings **10** into the box-like element **5** through the second end **7**, while the first hole **26** is smaller and cooperates with an end **28** of the pivot **8**,**8***b* opposite to the head **9** so as to guide, during use, rotation thereof about the axis A; the second hole **27** is furthermore provided with circumferential projecting parts **29** (FIGS. **2-4** and **5**) which are designed to snap-engage with radial play inside an annular groove **30** of the pivot **8**,**8***b* formed in the region of the head **9** so as to lock by means of snap-engagement the pivot **8**,**8***b* rotatably inside the box-like element **5**.

The second end **27** of the box-like element **5** finally is provided with a radially projecting flange **31** arranged facing and in contact with the head **9** of the pivot **8**,**8***b* so as to lock axially the box-like element **5** inside the perforations **4** in the direction of insertion D.

With reference now to FIGS. **12** and **13**, where the details similar to or the same as those already described are indicated for the sake of simplicity by the same reference numbers, the wings **10** are formed integrally as one piece with a pivot **8***c*, preferably by means of moulding from a synthetic plastic material and are configured as a lamina, so as to form together with the pivot **8***c*, also obtained by means of moulding from a synthetic plastic material, a single self-supporting rotating unit **17***c* made as one piece and replacing in the device **1** in FIG. **1**A the composite rotating unit **17**.

According to this variant, in order to allow insertion of the entire rotating unit **17***c* formed by the pivot **8***c* and by the wings **10** formed as one piece with the latter, the box-like element **5** of the device **1** is replaced with a box-like element **5***c* (FIG. **12**) which is identical, but provided at its second end **7** with a quadrangular aperture **32** for introducing the pivot **8***c* into the box-like element **5***c*; a perimetral edge **33** of the quadrangular aperture **32** is in particular designed chamfered so as to cooperate with the wings **10** during introduction of the pivot **8***c* into the box-like element **5***c* through the aperture **32**, so as to cause folding up thereof into the deformed or retracted configuration. As soon as the end **28** of the pivot **8***c* reaches the hole **26** the wings **10** no longer cooperate with the edge **33** and click into the extended configuration, thus making the device operative.

In the examples shown, the head **9** of the pivot **8**,**8***b*,**8***c* and/or the flange **31** of the box-like element **5**,**5***c* are provided with respective sealing gaskets **34**,**35** which are designed to enable the device **1**,**1***b* to close off in a fluid-tight manner the through-perforation **4** of the body parts **2**,**3** to be joined together.

With reference to FIGS. **1**D and **13**, where the pivot **8**,**8***c* is shown separately without gaskets, the head **9** is provided with a step-shaped perimetral edge **36** which receives a sucker-like annular gasket **34** directed towards the flange **31** and configured so as to house inside it said flange **31** so as to be able to cooperate during use with the body part **2** all the way around the perforation **4**, sealing it.

In addition or as an alternative to the presence of the gasket **34**, the flange **31** (FIG. **2**) may be provided with a pair of annular gaskets **35**, of the O-ring type, which are co-moulded with the box-like element **5**,**5***c*, which is preferably made by means of moulding from a synthetic plastic material. The annular gaskets **35** are fixed to corresponding opposite faces **37** and **38** of the flange **31**, in a radial position outside of the lateral wall **12** of the box-like element **5**,**5***c*. In this way, the gasket **35** of the face **37** cooperates making contact with the head **9** of the pivot **8**,**8***b*,**8***c*, preventing the entry of contaminants towards the hole **27** or **32**, while the gasket **35** of the face **38** during use cooperates with the body part **2** around the perforation **4**, sealing it in a fluid-tight manner.

In the examples shown, the box-like element **5**,**5***c* is prismatic and is made of synthetic plastic material. It has respective rounded edges **39** parallel to the axis A of the pivot **8**,**8***b*,**8***c*. In accordance with that shown schematically in FIG. **12**, the edges **39** are lined, at least along a stretch **40** arranged in the region of the second end **7**, with elastomeric pads **41**. In this way the pads **41** during use come into contact with the perimetral edge of the perforations **4**, preventing the generation of bothersome noise owing to any play due to the machining tolerances.

In all the embodiments described, the wings **10**, irrespective as to whether they form part of a metallic element **14**,**14***b* or whether they are made of synthetic plastic material formed as one piece with the pivot **8***c*, are provided with opposite longitudinal rims **42** facing towards the first end **6** of the box-like element **5**,**5***c* and arranged obliquely with respect to the axis A of symmetry of the pivot **8**,**8***b*,**8***c* so as to converge towards the axis A at the ends **6** of the box-like element **5**,**5***c* and **28** of the pivot **8**,**8***b*,**8***c*. The rims **42** therefore move closer, in a direction transverse to the axis A, towards the end **28** as they move closer from said axis A.

The longitudinal rims **42** are designed to be able to cooperate, during use, with the through-perforations **4** of the parts **2**,**3** to be connected so as to cause, during insertion of the box-like element **5**,**5***c* inside the perforations **4**, folding of the wings **10** inside the box-like element **5**,**5***c* and through the through-windows **11**, towards the elastically deformed or retracted configuration.

In particular, the longitudinal rims **42** of the wings **10** are folded in an L shape in opposite circumferential directions so as to be able to cooperate slidingly on the edges of the perforations **4**; furthermore, their oblique arrangement with respect to the axis A forms a receiving surface for the introduction of the wings **10** into the perforations **4** since the transverse dimension of the wings **10** along the transversal rims **13** is greater than the maximum transverse dimension of the perforations **4**, while the transverse dimension of the wings **10** at the end **28** of the pivot **8**,**8***b*,**8***c* is much smaller than the maximum transverse dimension of the perforations **4**.

The L-shaped form of the longitudinal rims **42** facilitates furthermore the passing movement over the teeth **24** when the pivot **8**,**8***b*,**8***c* is rotated from the second angular position towards the first angular position.

The transversal rims **13** of the wings **10** join the longitudinal rims **42** to the body of the pivot **8**,**8***b*,**8***c* and are each provided with a flap **43** folded in an L shape on the same side as the longitudinal rim **42** of the same wing **10**. The flap **42** of each wing **10** is designed to cooperate making bearing contact, during use, with the perimetral edge of the through-perforations **4** of the parts **2**,**3** to be joined together and enables better distribution, during use, of the pressures acting on the parts **2**,**3** so as not to damage them.

Also the transversal rims **13** with the associated flaps **43** are inclined towards the end **28** relative to the axis A, in particular so as to move closer towards the end **28** as they move away from the axis A.

They therefore allow the wings **10** to compensate for any axial play present between them and the parts **2**,**3** to be joined together, for example owing to slightly different thicknesses, owing to the elasticity of said wings **10**, causing them to flex slightly more or slightly less after they have unfolded into the extended configuration at the end of introduction of the box-like element **5**,**5***c* into the perforations **4**.

All the objects of the invention are therefore achieved.

The invention claimed is:

1. A retaining device (**1**; **1***b*), for connecting together vehicle body parts (**2**,**3**) provided with a through-perforation (**4**), characterized in that the retaining device comprises:

i)—a box-like element (**5**;**5***c*) which is designed to be inserted so as to pass through the perforation of the parts to be connected and has a first end (**6**) directed in a direction (D) for introducing during use the retaining device inside the through-perforation of the parts to be connected, and a second end (**7**), opposite to the first end;

(ii)—a pivot (**8**;**8***b*;**8***c*) mounted inside the box-like element (**5**;**5***c*) rotatably about its axis of symmetry (A) and provided with a head (**9**) arranged on the outside of the box-like element, at the second end (**7**) of the box-like element; and

iii)—a pair of elastically deformable wings (**10**) mounted in an angularly integral manner on the pivot (**8**;**8***b*;**8***c*) and extending longitudinally in a direction parallel to the axis (A) of the pivot, from which they project on opposite sides transversely jutting out; the wings (**10**) being configured so as to be able to assume: an undeformed or extended configuration, in which they have an L shape in a plane perpendicular to the axis (A) of symmetry of the pivot and project radially jutting out from the box-like element (**5**;**5***c*) through a pair of opposite through-windows (**11**) formed through a side wall (**12**) of the box-like element; and an elastically deformed or retracted configuration in which they are fully folded up inside the box-like element (**5**;**5***c*) assuming a U-shaped form in a plane perpendicular to the axis (A) of symmetry of the pivot;

iv)—the pivot (**8**;**8***b*;**8***c*) being selectively rotatable between a first and a second angular position; in the first angular position the wings (**10**) being situated facing the pair of opposite through-windows (**11**) of the box-like element and in the second angular position the wings **10** cooperating making contact with the side wall (**12**) of the box-like element so as to be forced to assume the deformed or retracted configuration;

v)—the wings (**10**) being configured so as to snap-engage, when the pivot (**8**;**8***b*;**8***c*) is in the first angular position, with the through-perforations (**4**) of the parts to be connected so as to clamp them together between the pivot head (**9**) and respective transversal rims (**13**) of the wings directed towards the second end (**7**) of the box-like element.

2. The retaining device according to claim **1**, characterized in that the wings (**10**) form part of single metallic element (**14**;**14***b*) which is elastically deformable and mounted in an angularly integral manner on the pivot (**8**;**8***b*) and made from a metal sheet cut and folded so as to assume an overall S-shaped form.

3. The retaining device according to claim **2**, characterized in that the pivot (**8**) has a transverse slot (**15**) which extends longitudinally, parallel to the axis (A) of the pivot; the metallic elastic element (**14**) having a flat central portion (**16**) which connects the wings (**10**) together and which is engaged inside the transverse slot (**15**) of the pivot.

4. The retaining device according to claim **2**, characterized in that the pivot (**8***b*) has a prismatic shape; the metallic elastic element (**14***b*) having a central portion (**16***b*) which connects the wings (**10**) together and which is configured as a radially deformable elastic prismatic sleeve which is fitted with interference onto the prismatic pivot (**8***b*).

5. The retaining device according to claim **4**, characterized in that the central portion (**16***b*) of the metallic elastic element (**14***b*) comprises a pair of first straps (**18**) which are folded in an L shape radially externally on a same first side (**19**) of the metallic elastic element and defining first and second opposite axial ends (**20**,**21**) of the central portion (**16***b*) of the metallic elastic element; and a second strap (**22**) folded in an L shape radially externally on a second side (**23**) of the metallic elastic element opposite to the first side and arranged axially between the first straps (**18**).

6. The retaining device according to claim **1**, characterized in that the wings (**10**) are formed integrally as one piece with the pivot (**8***c*), preferably by means of moulding from a synthetic plastic material and are configured as a lamina; the box-like element (**5***c*) being provided at its second end (**7**) with a quadrangular aperture (**32**) for introducing the pivot (**8***c*) into the box-like element (**5***c*); a perimetral edge (**33**) of the quadrangular aperture (**32**) being designed to cooperate with the wings (**10**), during introduction of the pivot (**8***c*) into the box-like element (**5***c*), so as to cause folding up thereof in the deformed or retracted configuration.

7. The retaining device according to claim **1**, characterized in that the wings (**10**) are provided with opposite longitudinal rims (**42**) directed towards the first end (**6**) of the box-like element and arranged obliquely with respect to the axis of symmetry (A) of the pivot so as to converge towards the axis at the first end (**6**) of the box-like element; the longitudinal rims (**42**) being designed so as to be able to cooperate, during use, with the through-perforations (**4**) of the parts to be connected so as to cause, during insertion of the box-like element (**5**;**5***c*) into the perforations, folding up of the wings (**10**) inside the box-like element and through the through-windows (**11**), towards the elastically deformed or retracted configuration.

8. The retaining device according to claim **7**, characterized in that the longitudinal rims (**42**) of the wings (**10**) are folded in an L-shape in opposite circumferential directions; and in that the transversal rims (**13**) of the wings connect the longitudinal rims (**42**) to the pivot (**8**;**8***b*;**8***c*) and are each provided with a flap (**43**) folded in an L shape on the same side as the longitudinal rim (**42**) of the said wing, the flap (**43**) being designed to cooperate making bearing contact, during use, with a perimetral edge of the through-perforations (**4**) of the parts to be joined together.

9. The retaining device according to claim **1**, characterized in that the box-like element (**5**;**5***c*) is provided, at each through-window (**11**) and in the region of the second end (**7**), with a lateral tooth (**24**) designed to cooperate by means of snap-engagement, during rotation of the pivot (**8**;**8***b*;**8***c*) towards the second angular position, with a corresponding wing (**10**) as the latter moves towards the deformed or retracted configuration so as to lock by means of snap-engagement the pivot in the second angular position; the lateral teeth (**24**) being designed to allow the disengagement

of the wings (**10**) when the pivot (**8**;**8***b*;**8***c*) is rotated in the opposite direction towards the first angular position; the box-like element (**5**;**5***c*) being further provided at the first and second ends with a first through-hole (**26**) and second through-hole (**27**;**32**), respectively, coaxial with the axis (A) of the pivot; the second hole (**27**;**32**) being designed to allow the introduction of the pivot (**8**;**8***b*;**8***c*) and the wings (**10**) into the box-like element (**5**;**5***c*) through the second end (**7**) and the first hole (**26**) cooperating with an end of the pivot opposite to the head (**9**) so as to guide, during use, the rotation thereof about the axis (A) of the pivot; the second hole (**27**;**32**) being further provided with circumferential projecting parts (**29**) designed to snap-engage with radial play inside an annular groove (**30**) of the pivot formed in the region of the head (**9**) of the pivot so as to lock by means of snap-engagement the pivot rotatably inside the box-like element; the second end (**7**) of the box-like element being further provided with a radially projecting flange (**31**) arranged facing and in contact with the head (**9**) of the pivot.

10. The retaining device according to claim **1**, characterized in that the head (**9**) of the pivot and/or the flange (**31**) of the box-like element are provided with respective sealing gaskets (**34**;**35**) designed to enable the device to close off in a fluid-tight manner the through-perforation (**4**) of the body parts to be joined together; the box-like element (**5**;**5***c*) being prismatic and having respective rims (**39**) parallel to the axis of the pivot which are lined, at least along a stretch (**40**) arranged in the region of the second end (**7**), with elastomeric pads (**41**).

11. A retaining device for connecting together parts provided with aligned through-perforations, comprising:

i)—a box-like element having a first end facing in a first direction, and a second end, opposite to the first end;

(ii)—a pivot mounted inside the box-like element rotatably about an axis of symmetry and provided with a head arranged on the outside of the box-like element, at the second end of the box-like element; and

iii)—a pivot mounted inside the box-like element rotatably about an axis of symmetry and provided with a head arranged on the outside of the box-like element, at the second end of the box-like element; and

iii)—a pair of elastically deformable wings mounted in an angularly integral manner on the pivot and extending longitudinally in a direction parallel to the axis of symmetry of the pivot, and projecting on opposite sides transversely jutting out; each wing being configured so as to be able to assume:

(a) an undeformed or extended configuration, in which the wing has an L shape in a plane perpendicular to the axis of symmetry of the pivot and projects radially jutting out from the box-like element through a corresponding through-window formed through a side wall of the box-like element, and

(b) an elastically deformed or retracted configuration in which the wing is fully folded up inside the box-like element and assumes a U-shaped form in a plane perpendicular to the axis of symmetry of the pivot;

iv)—the pivot being selectively rotatable between a first angular position and a second angular position; in the first angular position each wing being situated facing its corresponding through-window of the box-like element and in the second angular position each wing makes contact with the side wall of the box-like element so as to be forced to assume the deformed or retracted configuration;

v)—each wing being configured so as to snap-engage, when the pivot is in the first angular position, with the through-perforations of the parts to be connected so as to clamp them together between the pivot head and a respective transversal rim of the wing directed towards the second end of the box-like element.

12. The retaining device of claim **11**, wherein the wings form part of single metallic element which is elastically deformable and mounted in an angularly integral manner on the pivot and made from a metal sheet cut and folded so as to assume an overall S-shaped form.

13. The retaining device of claim **12**, wherein the pivot has a transverse slot that extends longitudinally, parallel to the axis of symmetry of the pivot; the metallic elastic element having a flat central portion that connects the wings together and that is engaged inside the transverse slot of the pivot.

* * * * *